

SECTION THREE

ASSESSMENT STRATEGIES

Student assessment is an important factor in developing mathematical competence and positive dispositions towards the subject. It is the means through which teachers collect and interpret information about students. This information enables them to evaluate students' achievements and the effectiveness of the teaching/learning experiences. Assessment and evaluation results are used to provide feedback to various stakeholders, particularly the students, and to identify appropriate follow-up strategies.

This section provides some guidelines for assessing and evaluating your students. It provides some insights into the purposes of assessment, the use of some selected assessment methods, procedures for planning and developing assessments, as well as using and communicating assessment information.

Purposes of Assessment

Assessment may be used to:

- § Diagnose students' difficulties.
- § Determine students' levels of achievement.
- § Make decisions about students' placement in class groups.
- § Facilitate planning for instruction.
- § Facilitate the instructional process.
- § Determine the effectiveness of the teaching/learning experiences
- § Determine the effectiveness of the curriculum materials.

Thus assessment may be carried out before, during, and after instruction. Figure 8 summarises the purposes of assessment at the various phases of the instructional process.

Figure 8. A synopsis of the timing and purposes of assessment

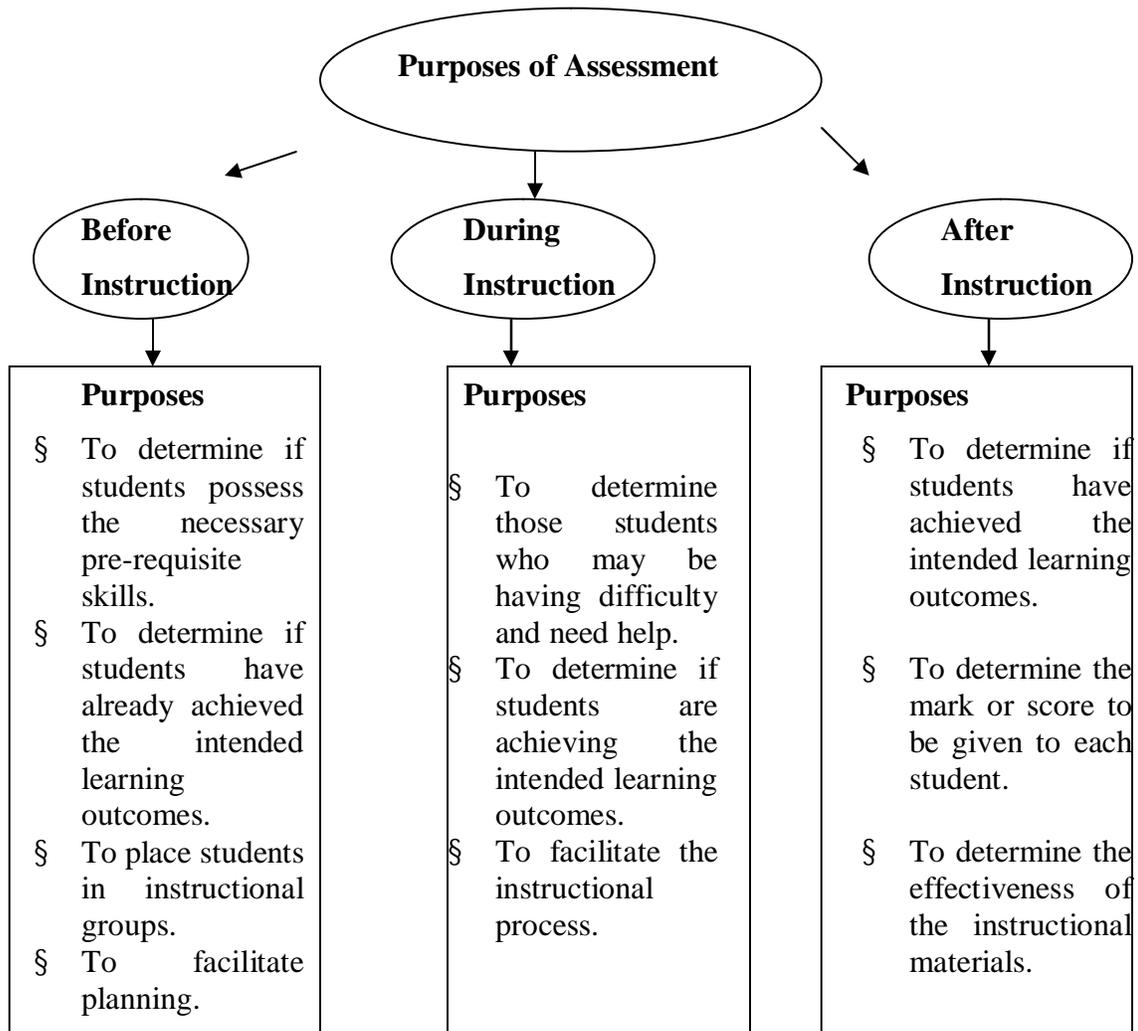


Figure 8 indicates that assessment could be carried out for a variety of reasons and that it is an integral part of the instructional process. For example, you may use assessment results to select and organise your teaching/learning experiences, to pace your lessons, to make decisions about whether your instructional plans should be altered, and to determine the effects of their instructional activities. Given the variety of reasons, it is essential that you use a variety of assessment methods, because no one method of assessment can provide information to satisfy all the purposes. This variety in assessment methods is also necessary because of the nature of mathematics. Each component of mathematics can be more appropriately assessed by some methods than by others. Thus, it is important to consider the procedures associated with a range of assessment methods.

Assessment Methods

The following assessment methods may be used to obtain information about students' performance in mathematics.

- § Journals
- § Observation
- § Oral assessment
- § Peer assessment
- § Pencil and paper tests or exercises
- § Portfolio assessment
- § Practical assessment
- § Projects and investigations
- § Student self-assessment

Journals

Journal writing is a means through which students can document their learning of mathematics. Through this documentation, journals can provide information that you can use to:

- § identify students' strengths
- § detect misconceptions
- § identify areas in which students need further instruction
- § determine students' feelings about their work
- § plan follow-up action which may be necessary to enhance their development.

The emphasis is on encouraging students to express how they think and feel about mathematics. Attention to the correct usage of language elements such as grammar and punctuation may vary over time. At times, it may be necessary to ignore incorrect use of language to allow students to focus on the mathematical aspect of the journal. However, the spelling and meaning attached to mathematical terms should always be monitored. Note that the incorrect language structures in the journals could be used as a basis for language lessons.

Figure 9. Examples of journal entries

Alex (Grade 6)

Today I learned about percents.. At first I thought that this was a totally new topic with a set of new procedures to learn. But when my teacher began to compare percents with fractions I realised I did not have much more information to learn. I could multiply fractions therefore I could work problems on percent

Tuesday April 12th

I enjoyed math class today. We went outside to collect information. Observe, my teacher said, look around you. We got information on the colour and types of cars parked outside the school. Some classes were having their break. We checked the colours of the children's lunch bags. We even observed those students who went to the canteen and recorded the snacks that they bought. That was fun!

The following are some additional guidelines for using journals as a form of assessment.

Suggestions for encouraging journal writing

1. The students could use an exercise book, scrap book or notebook for their journal. Encourage them to personalize it by decorating it with mathematical themes.
2. Journal entries could take a variety of forms. Some examples are:
 - § A collection of pictures that depict activities that involve mathematics, e.g., advertisements
 - § Drawings that illustrate the student's understanding of selected mathematics topics
 - § Brief notes on selected topics
 - § Reviews of activities that were done during mathematics lessons
 - § A listing of questions that the students would like to have answered
4. Prompt students to write entries for their journal by providing several stimuli. For example you could ask your students to complete statements such as the following:
 - § I learned that
 - § Something I would like to know about mathematics is
 - § I am good at ...
 - § I like ...
 - § I feel thatAdditionally you could ask them to complete specific tasks, for example: 'Write a story to go with this statement, $\frac{1}{4} + \frac{2}{5} = \frac{13}{20}$ '.
5. Journal entries can be done at home or at school. Initially, it may be more advantageous to have students write their entries in class, perhaps a 10 minute session per week. (Williams & Wynne, 2000).
6. Read and respond to the journals periodically. Feedback should be constructive.
 - § Note the students' achievements.
 - § Point out ways in which students could improve on their thought processes
 - § Correct errors and misconceptions.
 - § Praise students' efforts and encourage them to continue(Williams & Wynne, 2000).
7. Journals could be used as a basis for conferences with your students. Journal entries could also be shared with other students in the class, if the students want to do so.

Observation

Teachers regularly use observation as an assessment method. Most often it is informal, focussing on students, individually or as members of a group, as they participate in class activities. It may also be formally organised with plans outlining when the observation would take place, how long it would last, its purpose, and means of recording the data.

Observation may be used to assess students' ability to:

- § apply mathematical concepts
- § perform skills
- § solve problems
- § communicate mathematical ideas

Observation could also focus on students' dispositions, for example, their work habits and their use of group process skills.

Your informal observations of your students represent a tentative impression of your students' abilities. These impressions would need to be confirmed and therefore should be followed-up by formal observations. The following are some strategies for conducting formal observations.

Strategies for Formal Observation

1. Select one or two specific student characteristics as your focus during any one observation session.
2. Structure the classroom activities to provide the students with opportunities to demonstrate the selected focus.
3. Observe a few students at a time.
4. Base your judgments of the students on multiple observations of a behaviour. One observation of a behaviour is insufficient evidence for forming conclusions.
5. Check whether different methods of assessment provide similar information to that obtained from your observations. Corroboration of the observation evidence would allow you to be more confident about your conclusions.

For observations to be useful, you will need to keep some form of record. The records could include the concepts, skills, etc that the students have mastered and those

that they still need to work on. They may also include the type of difficulties that they are experiencing.

Perhaps the easiest way of documenting your records is to use a notebook in which you write down brief comments on your students' development. Such an insert could take the following form.

Figure 10. Example of a simple observation record

Date: 24/11/2002
Student's Name: Jeannette Jones
Comment: Jeannette stated that she did not like mathematics. She was reluctant to participate in class activities. She complained that the work was difficult. She has made this comment several times before.
Schedule a conference with her.

You can also use checklists, rating scales, and anecdotal records comprising of descriptions of the students' behaviours to document your observations. The following are some possible formats for these types of records.

Figure 11. An example of a checklist

The checklist is based on skills related to the calculating the total cost of set of items (Grade 3).

Student's Name -----		
Skills	Observations	
1. Uses pen and paper strategies, as necessary	Yes	No
2. Use mental computation, as necessary	Yes	No
3. Uses pen and paper strategies and mental computation	Yes	No
4. Checks the reasonableness of his/her answers	Yes	No
5. Writes amounts of money using the correct symbols	Yes	No

This format could be used as a record for one observation session with one student. It could be modified to record observations on several students by changing the response mode as shown below in Figure 12.

Figure 12. Example of a checklist for use with several students

Skills	Observations		
	John	Pearl	Ezra
1. Uses pen and paper strategies, as necessary	√		
2. Use mental computation, as necessary	√		
3. Uses pen and paper strategies and mental computation	√		
4. Checks the reasonableness of his/her answers	x		
5. Writes amounts of money using the correct symbols	x		

Key: √ Yes; x No

The above checklists could be modified to rating scales by changing the response mode for the observations from Yes/No to a scale such as Never, Sometimes, Always.

Another format of rating scales allows you to record several observation sessions on one scale. The following example is based on skills related to the sketching of triangles.

Figure 13. Example of a rating scale

Skills	Dates		
	20/10	12/11	24/11
1. Selects appropriate scales.	+		
2. Draws the axes in the correct position.	√		
3. Labels the axes correctly.	√		
4. Places the bars on the correct axis.	x		
5. Draws the bars the same distance apart from each other.	x		
6. Draws the bars to the correct height.	√		

Key: + Student has mastered the skill
√ Average performance, needs more practice
x The student is experiencing difficulty.

You can generate items for your checklists and rating scales by doing a task analysis to identify the sub-skills or concepts that students would need to acquire and perform to master a selected skill or concept. For rating scales such as the example in Figure 13, you will need to develop your own coding system with meanings for each of the symbols that you use.

Figure 14 illustrates a format for an anecdotal record. Note that in an anecdotal record the record of what was actually seen or heard is separated from the interpretation of the behaviour and the planned action to be taken.

Figure 14. An example of an Anecdotal Record

Name : Kenan Joseph			
Date	Observation	Interpretation	Action
Oct 6	Kenan disrupted Class frequently	Is perhaps seeking attention	Assign specific duties to him
Oct 8	Listened attentively; Participated in class; Stated that he did not understand the work.	May lack pre-requisite knowledge	Carry out an assessment based the pre-requisite concepts and skills

Oral Assessment

This type of assessment enables you to gather information on students' thoughts, understandings, and feelings about mathematics. Oral assessment may be carried out in several ways: e.g., through questioning, think alouds, interviews, and conferences.

Questioning. During the normal course of your lessons, you undoubtedly ask your students several questions. For these questions to be effective and provide you with information that you can use, even immediately, to facilitate student learning, they must be precisely phrased and varied. The following are some guidelines for using questioning.

Questioning Strategies

1. Avoid asking too many questions that require yes/no, one word, or short responses.
2. Use a variety of types of questions. E.g.,
 - § *Action questions* – How can we measure the distance from our classroom to the Principal’s office?
 - § *Diagnostic questions* – Which shapes are easy for you to draw? Why are they easy to draw?
 - § *Extension questions* – What other strategies can we use to solve this problem?
 - § *Evaluative questions* – Do you think that you have the right answer? Why? Why not?
 - § *Information questions* – How are squares and rectangles alike? How are they different?
 - § *Open-ended questions* – What are the various ways in which we can write 784?
 - § *Prediction questions* – What would happen to the product of 87 and 75 if one number is increased ten-fold and the other is decreased by 25?
 - § *Sequence questions* – What is the next step in adding these two proper fractions?(Airasian, 1997)
3. Encourage students to ask each other questions. You can develop their questioning skills by playing games such as ‘Twenty Questions’. For example, a student could select a number. The other students would then ask that student questions to determine the number.
4. Encourage students to comment on each other’s responses. For example, students may be asked to indicate whether they agree with the response of another student and to give reasons for their answer.
(Hatfield, Edwards, & Bitter, 1999; Stenmark, 1991)

Think alouds. This type of assessment requires students to verbalise their thoughts as they perform a task or an activity (Pike & Salend, 1995). Think alouds may be used to gather information on students' problem solving strategies, conceptual understandings, and their ability to make connections across topics. Students may be prompted to verbalise their thoughts through the use of questions such as:

- How are you finding the answer?
- What are you thinking now?
- What do you need to do next?
- Is that the only answer?

Interviews and conferences. Interviews are normally based on planned sequences of questions. The list of questions should also include some possible probing questions that could be used to gather additional information beyond the students' initial responses. Correct and incorrect responses should be probed. On the other hand, conferences are less structured and take the form of a discussion in which teachers and students share ideas (Stenmark, 1991). Questions arise out of the context. In either case, the questions should guide students to explain concepts and procedures, and how the concepts and/or procedures are interrelated.

Here are some guidelines for using think alouds, interviews and conferences.

Conducting think alouds, interviews and conferences

1. Set up an atmosphere that is conducive to assessment. Help the student to relax.
2. Allow students to use pencil and paper and other teaching/learning materials as necessary during the assessment. The materials that students use and how they use these materials provide insights into the extent of their understanding and abilities. For example, a teacher might discover during an interview that in measuring the length of a line segment, a Grade 6 student places her ruler any where along the line segment and then reads off the number on the ruler that is closest to the end of the line segment . Such information about the use of materials could indicate the type of experiences that the students need to help them improve.
3. Ask a variety of types of questions.
4. Use your think alouds, interviews and conference to encourage student self-assessment. Some possible questions are:
 - § What are some areas you find easy?
 - § In which areas would you like to improve?
 - § What did you find difficult/easy about ... ?
 - § What do you like about this topic?
5. Record important information about the student's achievements either during the assessment or immediately after.

Peer Assessment

Peer assessment is a process whereby students review and evaluate each others' work using a set of selected criteria (Airasian, 1997). The students exchange their work and discuss and judge the quality of the product. This method of assessment has several benefits. It helps students to broaden and deepen their understanding of mathematics. More specifically, it allows the students to:

- § Learn from each other.
- § Develop a full understanding of the criteria or standards against which their work is to be judged.
- § Gain a sense of how their work compares to others in their class.
- § Identify ways in which they can improve their work.
- § Review and further develop content, skills, and procedures covered during their classes.

You will need to help your students develop their ability to do peer assessments. You can use the following strategies.

Strategies for developing Peer Assessment abilities

1. Ask the students to state whether an answer to an oral question is right or wrong, complete or incomplete.
2. Allow a student to observe another student as he/she completes a task. The student who observes the procedure then states whether correct procedures were used. E.g., students can observe each other as they measure the length of objects in their classroom then state which aspects of the measurement were done correctly.
3. Follow-up on the student reviews with class discussions in which you:
 - § Point out the strengths and weaknesses in the students' work.
 - § Give reasons why the examples fall into particular categories.
E.g., This is correct because....
This is incorrect becauseThe discussions will help the students to identify acceptable and unacceptable standards.
4. Involve your students in developing the criteria that will be used to judge their work. This could be facilitated by having them compare good and poor examples of a product or performance to identify the characteristics of the good examples. These characteristics can then be used to form the criteria. Work with your students to write the criteria in language that they can understand.
5. Discuss the criteria with the students to ensure that they understand them.
6. Show the students how the criteria could be used. Let them use these criteria in carrying out their peer assessments.

The following example of a set of criteria is related to the problem solving process.

Figure 15. An example of a set of criteria for peer assessment

<i>Peer Assessment- Criteria for 'Creating Problems' (Grade 6)</i>		
These criteria may be used to check the problems that your classmates write. Read your classmates' problems then answer the questions.		
1. Does the problem have all the information that you need to solve it?	Yes	No
2. Does the problem have too much information?	Yes	No
3. Does the problem have one correct answer?	Yes	No
4. Does the problem have many correct answers?	Yes	No
5. Is the problem easy?	Yes	No
6. Is the problem challenging?	Yes	No
7. Has the mathematical language in the problem been used correctly?	Yes	No

You will need to monitor your students' use of peer assessment. You could do so by observing and talking with them during the peer assessment sessions or by organising class discussions after the sessions. The focus of these activities should be to check whether the students:

- § understand the criteria
- § are using the criteria properly
- § are providing appropriate feedback to their peers
- § understand or have mastered the mathematical ideas, skills or procedures that are being assessed.

According to the information that you obtain from the monitoring activities, you will need to provide appropriate follow-up experiences for the students.

Pencil and Paper Tests and Exercises

Pencil and paper tests and exercises are comprised of written items that are based on a selected set of learning outcomes. Students respond to the questions posed or provide information as specified by the task in the items. These tests and exercises are often aimed at assessing student achievement, that is, what they have learned and what they need to learn. More specifically, the tests and exercises can be used to:

- § Determine the extent to which the students have developed the relevant concepts, skills, and procedures.
- § Determine specific difficulties that students are encountering.
- § Diagnose individual students' strengths and weaknesses.

Four main types of teacher-made tests are achievement tests, diagnostic tests, mastery tests, and practice tests/exercises.

- § Achievement tests are made up of a set of items that sample the learning outcomes of a unit or several units of work.
- § Diagnostic tests are designed to determine students' strengths and weaknesses in a narrow range of content. Each concept or skill is tested by at least three items. The students' responses are analysed to determine patterns of errors in each group of items.
- § Mastery tests are based on a single topic, e.g., subtraction of whole numbers. The items are arranged from the simplest to the most difficult. Given the emphasis on mastery, a minimum level of acceptable performance is often set. To demonstrate mastery of the topic, students are expected to meet or surpass this minimum level.
- § Practice tests/exercises are normally administered after instruction. They focus on a limited set of learning outcomes. These tests/exercises, which are completed as class work or homework, are used to determine the concepts or skills that the students have acquired, their misconceptions and difficulties, and basically the effectiveness of instruction.

(Carey, 1994)

As with any assessment, your main task in developing pencil and paper tests and exercises is to ensure that the items correspond with what has been taught and the

way in which it was taught. You should also ensure that the items are clearly stated and that they are appropriate for the students.

Test items may take the form of essay items or objective items. Essay items may be structured or unstructured. Structured essay items usually consist of a set of related problems. In some cases, students are guided to complete a task through a series of questions that focus on the components of the task. Unstructured essay items allow the student the freedom to choose the mode of response.

Example of a structured essay item

John takes 45 minutes to cut the grass in the neighbourhood lawns. He takes 15 minutes to weed a flower bed. He has to cut the grass in 5 lawns and weed 14 flower beds.

- (a) How long will it take him to cut the grass in all the lawns?
- (b) How long will it take him to weed the 14 flower beds?
- (c) How long will it take him to complete his tasks of cutting and weeding?

Example of an unstructured essay item

There are 32 children in a class. There are 54 books in the class library. Are there enough books for each child to read one book in school and have one book to take home for a week? Give reasons for your answer.

Objective items may take the form of multiple-choice, alternate response, matching, or short answer items. Test items may incorporate the use of pictorial representations of mathematics. Before any of these types of items are included on a test, the students should have had an opportunity to learn about the structure of the items and

how they should respond to the items. This familiarization is necessary to ensure that the tests/exercises are assessments of the students' abilities and not other characteristics.

Portfolio Assessment

A portfolio is a collection of a student's work that documents and presents the student's efforts, progress, and achievement in several areas over time (Paulson, Paulson, & Meyer, 1991). These areas may be related to content strands, topics, curricular emphases, or learning outcomes. Portfolios, therefore, may be used to assess process and product outcomes related to the cognitive, affective, and psychomotor domains, and more specifically, outcomes related to the unifying processes of problem solving, reasoning, communication, and making mathematical connections. They have the potential for encouraging students to be active learners. They also provide opportunities for students to reflect on their work and to take responsibility for their learning.

A portfolio should include the following:

- § A table of contents
- § Samples of the student's work. Some examples of possible entries are
 - Draft attempts at the solution to a problem
 - actual solutions of problems
 - diagrams or paragraphs that describe the links between mathematical topics
 - reports on investigations
 - paragraphs on their feelings about mathematics
 - photographs of models in various stages of development.
 - Journal entries
- § Reflective entries that explain why he/she included each of the work samples.
- § Evaluative comments, made by the student, teacher, or his/her class mates, on the quality of the samples of work.

You can help students to reflect on their work by providing them with prompts or questions. Some examples are:

- § I learned a lot about
- § This happened because
- § I chose this sample of work because ...
- § The areas that I need to improve on in this sample of work are ...

It must be noted that a portfolio is different from a folder that holds all of the students' work. The samples must be carefully selected to show growth and to highlight the student's best or typical work in each of the areas on which the portfolio is based. The following are some guidelines for selecting the entries.

Selection of Portfolio Entries

1. To develop student ownership of the portfolios, it is advisable to allow students to make some decisions about the samples to be included in their portfolios. *Entries, therefore, could include some that you require/select and some that the students select.*
2. Students could use questions such as the following to guide their selections:
 - § In which areas did I learn the most? Why?
 - § Which samples of work did I enjoy working on the most? Why?
 - § Which of these samples of work show the most improvement?

You should periodically review portfolio contents with your students to judge the quality of their work and to document progress. As with peer and self-assessment, you and your students could collaborate on the development of criteria for judging the quality of the contents.

The assessment and evaluation of the completed portfolio consists of two steps: marking of the individual samples of work and an overall judgment of the entire portfolio (Airasian, 1997). Your overall judgment of the portfolio could consider the following areas.

- § Organisation of the entries
- § Tidiness of the work presented
- § Understanding of concepts
- § Acquisition of skills and procedures
- § Ability to apply concepts and skills
- § Levels of attainment related to the curricular emphases

§ Quality of the self-assessment/ the evaluative comments made by the student

Evaluation of portfolios could also involve a conference with students. During the conference, you should provide feedback on the portfolio and give the students an opportunity to talk about the portfolio contents and explain how their understanding might have changed since inclusion of the entry.

Practical Assessment

The mathematics curriculum contains several outcomes that involve practical work. Practical assessment is aimed at these types of outcomes and at determining the students' ability to translate their knowledge and understandings into action (Airasian, 1997). Four broad domains of learning in mathematics could be assessed through practicals. These domains are:

- § Communication skills – e.g., explaining a procedure, pronouncing mathematical words, counting numbers in sequence, following directions.
- § Psychomotor skills – e.g., using mathematical instruments, drawing shapes, constructing models (such as 3-dimensional shapes).
- § Concept acquisition – e.g., selecting appropriate instruments for a task (such as measurement), using data collection methods.
- § Affective skills – e.g., working in co-operative groups, sharing materials.

(Airasian, 1997)

Many of these domains and the associated outcomes would be assessed formatively through observation of associated practical activities during the course of a lesson. These outcomes are also sometimes assessed through written tests. For example, a pencil and paper test could contain an item that requires students to measure a line segment. In such cases, only a product, the answer to the item, is being assessed. However, to determine students' ability to measure line segments, assessment of the student in action as he/she actually uses a ruler to measure a line segment is also necessary.

It is therefore necessary to set up assessments that require students to perform practical tasks while being observed. Such assessments could involve individuals or small

groups of students at a time. Moreover, to check for consistency and to ensure that students have acquired the concepts or skills under review, the assessments should include several tasks related to the outcomes. In the example above, a teacher could ask the students to measure several line segments rather than just one. The following is an example of how a practical task could be structured.

Figure 16. Example of a practical task

<i>Measurement of length</i>	
<i>Topic:</i> Measurement of length using standard units	
<i>Task:</i> Select the appropriate instruments and units of measurement that should be used to measure the objects listed below. Measure the objects then record your measurements in the blanks.	
Length of the classroom	_____
Width of the chalkboard	_____
Height of your desk	_____

Rating scales and checklists could be used to record the results of the assessment. You can use the following procedures to develop your rating scales and checklists for practical assessment.

Developing rating scales and checklists for practical assessment

1. Break down the overall task into its component parts. The following are some useful strategies.
 - § Perform the task yourself and take notes of the important physical actions and mental activities.
 - § Watch someone, preferably a student of the same grade level as your students, whom you consider to be proficient at the task carrying out the task. Note the important physical actions. Speak with him/her about the mental activities that accompanied the performance of the task. Take note of these activities.
 - § Use your notes to develop a set of important component actions.
2. Arrange the important component actions into the sequence in which they are most likely to be performed.
3. Use these actions to formulate clearly stated criteria that describe what the students should do or say. Limit the number of criteria to ensure that they can feasibly be used in the classroom.
4. Prepare your rating scale or checklist by attaching an appropriate scale to your list of criteria.
5. Tryout and review your rating scale or checklist. Ask a colleague to review it. Modify the scale or checklist, as necessary.
(Carey, 1994)

You can score the performance by assigning a score to each rating (e.g., 1 for yes, and 0 for no) and adding these to obtain an overall score. However, attention should also be given to identifying those sub-tasks that students performed well and offering suggestions on how to improve on those aspects which were not done correctly.

Projects and Investigations

Projects and investigations are aimed at assessing students' abilities to plan, construct, and present a response to complex tasks that involve the use of several mathematical concepts and skills that students have developed (Carey, 1994). More specifically, they may be used to assess students' ability to:

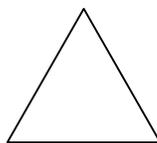
- clarify and solve problems
- formulate and test hypotheses
- collect and organise relevant data or information
- explain problem solving strategies

They are also useful in the assessment of personal qualities such as:

- persistence
- initiative
- willingness to go beyond a given task.

These assessment methods also provide opportunities for co-operative group work and, therefore, they could be used to monitor students' development of group process skills.

Students' questions and answers provide a rich source of ideas for projects and investigations (James, 1995). For example, if students consistently draw the following type of shape to represent a triangle, they could be asked to investigate whether all triangles have sides of equal length.



The students can also suggest ideas for projects and investigations.

Assessment of projects and investigations could focus on the process of completing the tasks and/or the products. Thus in preparing the assessment tasks, you will need to provide sufficient information to help students organise their work and decide on the type of response to present. This information could include: the length or scope of the response, the marks to be awarded, and the time available for completing the task (Carey, 1994). The following example of a project illustrates how this information may be provided.

Figure 17. Example of a project

Three-dimensional Shapes and their Nets

This project is about three-dimensional shapes and their nets. Complete the tasks described below. Put your responses to the tasks together in a booklet.

You have 2 weeks to work on this project. Please hand in your work on May 16, 2003.

1. Collect a number of boxes of different shapes and sizes. Describe the shape and size of each box. You may label your boxes, e.g., Box A, Box B, etc. **(10 marks)**
2. Sketch each box on a separate sheet of paper. Open up your boxes carefully. Draw the net of each box on the opposite side of the sheet of paper on which you sketched the box. **(20 marks)**
3. Write some comments on your boxes. Here are some questions that you could consider.
 - a. In opening up your boxes, did you find that large boxes were sturdier than small boxes? Give some reasons for what you found.
 - b. Look at those boxes that had covers. How are the nets of the two parts of the boxes alike? How are they different? **(10 marks)**

One of the issues associated with projects is the amount of help that teachers should provide to their students. You may need to give some guidance and help students prepare their response. If most of the students need a large amount of help, then the task might be too difficult for them, and it should be modified. Additionally, if there are students who need more help than the others, you should take a note of this and follow-up to find out the types of difficulties they were experiencing and the reasons for the difficulties so that appropriate action could be taken.

You could use analytical scoring to mark projects and investigations. This type of scoring involves identifying the main components and sub-components of the task, deciding on the maximum number of marks to be given to each component and sub-component, then awarding marks to the students' product based on its quality (Gronlund, 1998). To mark process-oriented responses, you could use the procedures outlined for practical assessment.

Student Self-assessment

Students engage in self-assessment when they analyse and reflect on their work and make judgments about their performance. In using this form of assessment, you should encourage the students to appraise their work skills, social skills, and academic skills (Lemlech,1998). The following are some prompts which may be used to stimulate self-assessment.

<p><i><u>Academic Skills</u></i></p> <p>I really learned a lot today_____</p> <p>I learned a little bit today_____</p> <p>I did not learn much today_____</p> <p>This happened because_____</p>

<p><i><u>Academic Skills</u></i></p> <p>I really needed help today_____</p> <p>I needed a little bit of help today_____</p> <p>I did not need help today_____</p> <p>This happened because _____</p>
--

<p><i><u>Work Skills: Group Process Skills</u></i></p> <p>We set out to do _____</p> <p>We were able to do_____</p> <p>We still need to do_____</p> <p>We need help in _____</p> <p>We do not need help because_____</p>
--

You will need to guide and help students to develop their self-assessment capabilities. To do so, you could use strategies similar to those that have been outlined for peer-assessment.

An important aspect of self-assessment is the follow-up action that is taken on the basis of the assessment. Some students may recognize their weaknesses and take the necessary steps to improve. For the other students, you might need to take the initiative to help them improve. This initiative may require that you do more assessments and /or reviews of the areas in which the students are experiencing difficulty.

Planning for Assessment

Effective student assessment depends to a certain extent on the methods that are used but more importantly on the plans that are made for use of the various methods. Ideally, you should develop your plans for assessment at the same time that you are planning for instruction. Thus as you plan for a term, week, or lesson, you should outline how you will assess students' achievement of the selected outcomes.

The following are some guidelines for developing your plans.

Planning Activities

1. Decide on your goals for the instructional period. Select the appropriate outcomes.
2. Find out what your students know and can do already. This phase includes:
 - § Gathering information from the students
 - § Recording the information
 - § Using the results to make decisions about the outcomes to be developed, the sequence in which they would be developed, and the activities to be used.
3. Develop your instructional plans, outlining the outcomes and content to be developed and the teaching/learning experiences that will be provided for the students.
4. Develop your assessment plans.
 - § Identify the points/times in your instructional sequence when you will assess the students.
 - § Select the assessment methods that are most appropriate for the outcomes to be developed.
 - § Prepare drafts of the assessment tasks that students will carry out.
5. Inform your students, as appropriate, of the timing and nature of the assessments, that is, when and how you will assess them.

In selecting the methods of assessment that are appropriate for a set of outcomes, it is important to note that all the methods discussed in this section of the Guide could be used with each of the content strands.

Developing Assessment Tasks

Once you have outlined your general plans for assessment, you should then go on to develop tasks for each of the specific assessment methods that you selected. To do so, you may carry out the following steps.

Steps for developing assessment tasks

1. Identify and define the learning outcomes that you will assess.
2. Prepare a plan that outlines the types and number of tasks that students will carry out in relation to each outcome.
3. Review your drafts of the tasks that you prepared during the planning phase. Modify these, if necessary, to suit the age and ability levels of the students and the instructional activities.
4. Develop additional tasks, if necessary.
5. Review your tasks. Also have a colleague review them. Check that the tasks are clearly stated, related to the selected outcomes, and consistent with the students' instructional experiences.
6. Revise the tasks, if necessary.

Another factor that you will need to consider as you develop your assessments is the length of time to be allotted to the assessment. You should consider your students' age, attention span, and the complexity of the task in deciding on the time frame in which the assessment is to be carried out. Additionally with respect to timing, you should schedule the assessments at a time that will permit the students to show their best work.

Using and Reporting Assessment Results

The assessment strategies outlined in this section suggest that it is possible for you to obtain a range of information about students. For this information to be useful, you will need to keep good records of the students' achievement. Several of the assessment methods have built-in structures for recording assessment information. These should be used to their fullest advantage.

The records of students' performance should be analysed and used to evaluate their achievement of the learning outcomes. For each student in your class, you should be able to:

- § give a brief description of the outcomes the student has achieved, those that he/she has mastered, and those with which he/she is having difficulty.
- § comment on the nature of the difficulty.
- § Comment on the students' personal qualities such as work habits and attitudes towards working with others.

This type of information is useful and should be passed on to the students. Feedback to students should be provided in a variety of ways. For example, you should provide feedback to the class as a whole on their strengths and weakness ways of improving their performance. It is also important to discuss a students' performance with him/her individually in a conference. Stars and other motivating stickers also effectively inform students of their level of achievement. Your comments on their written work would also be welcomed and remembered.

Parents, other teachers, and Curriculum Officers also require feedback on students' performance. This feedback may be provided through memos or letters, conferences, open days at the school, and report books. Such reporting of assessment information could strengthen the existing networks among the various groups of persons who are involved in facilitating student learning and development.

As information about students' achievement is shared among the various stakeholders, care should be taken to ensure that it does not only focus on the end-product- the outcomes that the students have attained- but that it also provides an indication of the teaching/learning experiences that enabled the students' achievements and the assessment strategies that were used. The discussions could focus on the effectiveness of the teaching/learning experiences in enhancing student learning and reasons for the success or lack of success. They can also address the appropriateness of the selected assessment strategies and the follow-up action that would be taken to maintain or improve the students' levels of achievement. Indeed, it is by sharing ideas about effective teaching and assessment strategies and the contexts in which they work, that you can build up a repertoire of useful ideas for teaching and assessing mathematics.